BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1811

In the Matter of	)
	)
PORTLAND GENERAL ELECTRIC COMPANY,	)
	)
APPLICATION FOR TRANSPORTATION ELECTRIFICATION PROGRAMS.	)
	)

REPLY TESTIMONY

OF THE

OREGON CITIZENS' UTILITY BOARD

April 24, 2017

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I. INTRODUCTION

My name is Bob Jenks. My qualifications are provided as CUB Exhibit 101.

First, CUB wishes to compliment Portland General Electric ("PGE" or "the Company"). PGE took the challenge of SB 1547 seriously, held a series of well-run workshops, and developed a series of actions and pilots which aim to advance the goals of SB 1547. In this sense, the Company's application for transportation electrification ("TE") programs captured the spirit of the goals contemplated in SB 1547.

However, while CUB generally believes that PGE has identified a set of well-defined actions that do advance the goals of SB 1547, CUB remains concerned that PGE's collection of pilots is more focused on doing **something** to accelerate sales of electric vehicles ("EVs"), rather than focusing on what **needs** to be done to accommodate the EVs that will be added to its system. In short, while PGE's pilots and actions will likely help accelerate TE in Oregon, they do not provide CUB with enough assurance that EVs will be managed in a manner that will reduce costs to PGE customers. In evaluating utility program applications, it is important to recognize how those program applications prepare Oregon utilities for a future where electricity

is a significant transportation fuel. The science of climate change tells us that electricity must replace fossil fuels as a transportation fuel.[1]

CUB's testimony covers a number of areas:

I. ***Context: EVs, Climate Change, Utilities and SB 1547***. CUB felt it was necessary to spend a little time discussing the context for viewing these plans. In order to consider what should be done to support EVs, it is important to understand the starting point.

II. ***PGE's Transportation Electrification Plan.*** CUB discusses each element/pilot proposed in PGE's plan. CUB is concerned that PGE's Outreach and Technical Assistance pilot includes costs that are already appropriately in base rates. CUB supports PGE's Mass Transit Program as a limited pilot, but CUB is concerned that this is not the best model for additional investments. CUB has concerns about PGE's Community Charging investments and its modeling of costs and benefits of that program. CUB is supportive of PGE's Smart Charging Pilot.

III. ***Time of Use ("TOU"), Managed Charging and Level 2 Incentives.*** CUB discusses the role of Time-of-Use and managed charging and urges PGE to evaluate a cost-based incentive for Level 2 home charging to enable TOU and managed charging.

IV. ***DEQ Clean Fuels Rulemaking – Low Carbon Fuel Standard.*** CUB is concerned that PGE did not register as a credit generator for 2017.

[1] S.B. 1547 § 20(2)(a) comments on the additional future benefits, and states that "[TE] is necessary to reduce petroleum use, achieve optimum levels of energy efficiency and carbon reduction, meet federal and state air quality standards, meet this state's greenhouse gas emissions reduction goals described in ORS 468A.205 and improve the public health and safety."

V. ***Home Charging Opportunities.*** CUB urges PGE to think proactively on the future needs for home charging infrastructure, focusing on new construction and mult-family housing.

II. CONTEXT: EVs, CLIMATE CHANGE, UTILITIES, & SB 1547

CUB uses the term "EVs" broadly. It includes cars that are fully electric ("BEV"), plug-in hybrid electric vehicles ("PHEV"), electric buses, electric forklifts, and other uses of electricity to power a vehicle.

A. *Electrifying Transportation is a Necessity*

CUB recognizes that electrifying transportation is necessary. Carbon emissions from the electric sector have declined by 19% since 2005.[2] Oregon's largest source of carbon emission, PGE's Boardman coal plant, is scheduled to close in 2020. PacifiCorp's IRP has identified several coal plants that it expects to shut down for economic reasons.[3] Our electric grid is becoming cleaner and this trend will continue.

Transportation, on the other hand, shows growing carbon emissions and has overtaken the power sector as the largest US source of carbon emissions[4]. Increasingly, climate activists will focus their energies on EVs. Widespread EV proliferation is necessary to reduce carbon emissions to a level that scientists say is sustainable.

Oregon has a Transportation Strategy to reduce emissions, with a 2050 goal of reducing transportation carbon emissions to 75% below 1990 levels. According to that Strategy[5]:

[2] Jonathan L. Ramseur Congressional Research Service, April 2016, https://fas.org/sgp/crs/misc/R44451.pdf.
[3] *See in re PacifiCorp's 2017 Integrated Resource Plan*, OPUC Docket No. LC 67 (Apr. 4, 2017).
[4] http://www.vox.com/2016/6/13/11911798/emissions-electricity-versus-transportation
[5] Oregon Department of Transportation, Oregon's Statewide Transportation Strategy:
A 2050 Vision for Greenhouse Gas Emissions Reduction, presented to Oregon Global Warming Commission, June 29, 2012.

- When the plan was established in 2010, carbon emissions had grown by 33% from 1990 levels.

- To reduce emissions by 45% from 1990 levels, 30% of vehicles need to be EVs (specifically PHEV and BEV).

- To achieve the state's goal of a 75% reduction, 53% of vehicles need to be EVs.

The City of Portland also has a transportation strategy as part of its climate plan:

> Portland's Climate Action Plan also includes goals to decrease Portland's transportation-related carbon emissions 25 percent below 1990 levels by 2020, 40 percent by 2030 and 80 percent by 2050. To reach those goals, the current commute mode split will need to shift toward walking, bicycling and public transit, and the number of people commuting in single occupancy vehicles will need to decrease from 59 percent to 20 percent by 2030 (see Figures 2 and 3). A growing proportion of the vehicles that remain on the road in 2030, including public transit and commercial vehicles, will need to be powered by electricity. Specifically, it is estimated that 10 to 15 percent of all noncommercial vehicle miles traveled on Portland's roads in 2030 will need to be in electric vehicles to achieve Portland's broader carbon emission goals.[6]

According to the State of Oregon, to reduce transportation emissions by 45% from 1990 levels, 30% of vehicles must be electric. The City of Portland says that to reduce transportation emissions by 40% below 1990 levels, will require 10 to 15% of vehicle miles to be electric. Either way, tens of thousands of vehicles in PGE's service territory will need to shift from gas to electric powered over the next few years. PGE projects that even without its TE plan, there will be more than 200,000 by 2030.[7]

B. *Oregon's Current EV Penetration and Infrastructure*

Oregon has an extensive public charging infrastructure. According to EV Obsession, a website that reports on EV news and sales, citing 2015 data, Portland already has more Level 2 (240 volt) public chargers than any of the other 25 largest US cities and:

[6] 2017 CITY OF PORTLAND ELECTRIC VEHICLE STRATEGY, page 2, https://www.portlandoregon.gov/bps/article/619275
[7] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017, p 71.

> Oregon has the best DC fast-charging infrastructure in the country, with roughly four-dozen quick-charge sites spread along 10 different highways.[8]

PGE's TE program application suggests investments in EV public charging infrastructure are increasing rapidly. PGE identifies 105 sites with DC fast chargers today, which is more than twice the number of quick charging sites reported by EV Obsession in 2015.[9]

While Portland and Oregon may lead the country in charging infrastructure, we are 6th in percent of EV sales (new cars) and 6th in EVs per capita.[10] This suggests that charging infrastructure alone is not the driving factor for EV sales. Cities with a greater share of vehicles have additional incentive programs, such as state tax credits, free parking, and the ability to use car pool lanes on freeways:

> However, there are a few outliers to the general pattern, and Oregon is one of the most interesting. It is one of the leading U.S. states for EV sales, over 1.5% of the new-vehicle market in 2014 – about double the U.S. average. But it offers no subsides, and the only state-level incentives (that is, in addition to the $7,500 U.S. federal tax credit for purchasing an EV) are a small tax credit for home chargers and an exemption for emissions testing for EVs. The other states with EV sales shares over 1.5% have attractive incentive packages: in 2014 California, Georgia, and Washington all offered sizeable tax credits or rebates. California and Hawaii allowed EV drivers carpool lane access to avoid some of the country's worst traffic congestion. Hawaii also offered free and dedicated parking, a valuable commodity in crowded Honolulu.
>
> What makes Oregon different? For one thing, Oregon has a LOT of publicly available EV charging stations – a factor we hadn't included in the analysis of state incentives. The Department of Energy reports that Oregon has over 400 public charging stations and over 950 individual charging outlets. Many of these are clustered in Portland, which is the highest per capita density of chargers in the 25 largest U.S. cities. In fact, the Portland metropolitan area has 6 times the density of DC-fast electric fast charging infrastructure per capita than the average major US metropolitan area.[11]

It should be recognized that EVs have established a presence in PGE's service territory and, with or without PGE's investment, they will likely make up an increasing share of the

[8] http://evobsession.com/top-ev-cities-in-us-10-charts/
[9] PGE Transportation Electrification Plan, December 2016, page 14.
[10] http://evobsession.com/top-ev-cities-in-us-10-charts/
[11] http://www.theicct.org/blogs/staff/oregon-success-story-electric-vehicles.

transportation market. As the price of EVs fall and the range increases,[12] more consumers who are concerned about climate change will be able to purchase them.

> Goldman Sachs projects that electric vehicles will account for 22% of the global car market by 2025—a share reached in Norway in 2015. Bloomberg New Energy Finance estimates the worldwide EV market share will reach 35% by 2040, or even more in some scenarios.[13]

C. *Role of Utilities*

With tens of thousands of new EVs expected in PGE's service territory, the Company needs to be prepared. Even without SB 1547, PGE was preparing for new EV load, and the PUC considered the implications in a docket (UM 1461).

Planning and preparing for this new load is something that a prudent utility needs to do. Failing to prepare for EVs will harm customers. According to the Rocky Mountain Institute ("RMI"):[14]

> [I]f utilities respond to EV loads late and reactively, that could:
>
> • Shorten the life of grid infrastructure components
> • Require greater investment in gas-fired peak and flexible capacity
> • Make the grid less efficient
> • Increase the unit costs of electricity for all consumers
> • Inhibit the integration of variable renewables, and increase curtailment of renewable generation when supply exceeds demand
> • Increase grid-power emissions
> • Make the grid less stable and reliable

[12] The battery cost and weight for EVs will decline by 63% and 52%, respectively, in the next five years, while capacity and range will improve by 50% and 72%: Garrett Fitzgerald, Chris Nelder and James Newcomb. Electric Vehicles as Distributed Energy Resources, Rocky Mountain Institute, 2016, p. 7 http://www.rmi.org/Content/Files/RMI_Electric_Vehicles_as_DERs_Final_V2.pdf

[13] Garrett Fitzgerald, Chris Nelder and James Newcomb. Electric Vehicles as Distributed Energy Resources, Rocky Mountain Institute, 2016, p. 7 http://www.rmi.org/Content/Files/RMI_Electric_Vehicles_as_DERs_Final_V2.pdf

[14] Fitzgerald, Chris Nelder and James Newcomb. Electric Vehicles as Distributed Energy Resources, Rocky Mountain Institute, 2016 p. 6 http://www.rmi.org/Content/Files/RMI_Electric_Vehicles_as_DERs_Final_V2.pdf

However:

> If utilities anticipate the load of charging EVs and plan for it proactively, they can not only accommodate the load at low cost, but also reap numerous benefits to the entire system. Shaping and controlling EV charging can:
>
> • Avoid new investment in grid infrastructure
> • Optimize existing grid assets and extend their useful life
> • Enable greater integration of variable renewables (wind and solar photovoltaics) without needing new natural-gas generation for dispatchable capacity, while reducing curtailment of renewable production • Reduce electricity and transportation costs
> • Reduce petroleum consumption
> • Reduce emissions of CO2 and conventional air pollutants
> • Improve energy security
> • Provide multiplier benefits from increased money circulating in the community
> • Supply ancillary services to the grid, such as frequency regulation and power factor correction

CUB is concerned that PGE's focus is on neither achieving these benefits nor avoiding these harms. Instead, it is focused primarily on increasing the sales of EVs. Below is the graph from PGE's Application that shows projections of EVs.[15] It visually demonstrates CUB's concerns. PGE is primarily focused on the incremental increase in EV sales its program will create, rather than the much larger forecast of EVs coming their way. As RMI suggests, there are costs to PGE's system, if PGE responds to EV loads late and reactively.

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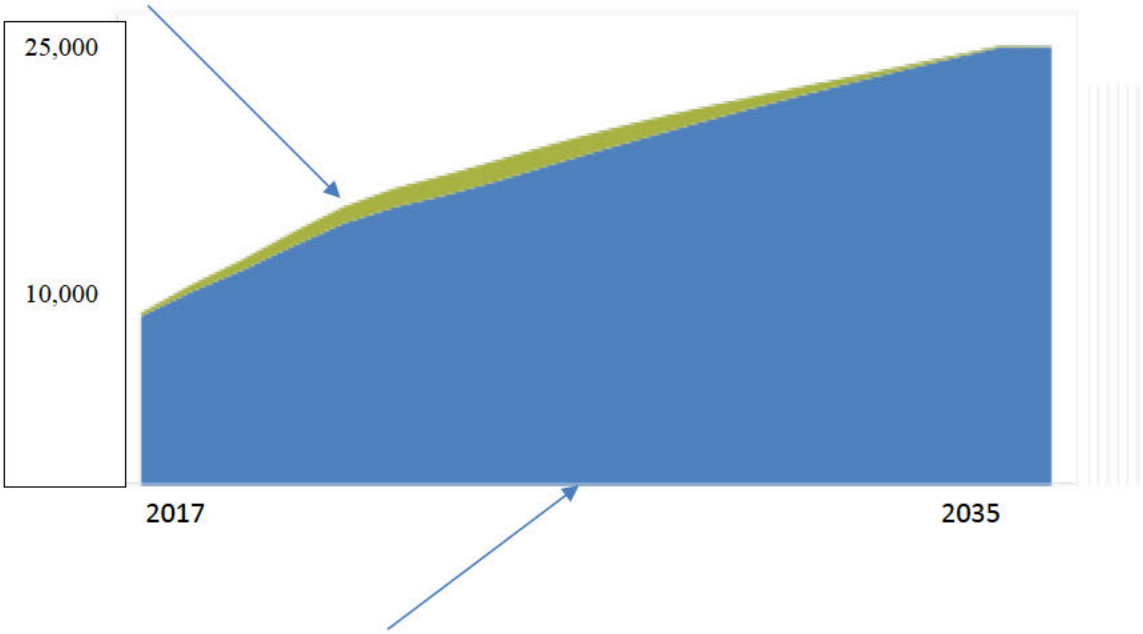
[15] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017, p 72.

PGE is focused on the green



PGE should focus on the blue

Focusing on the expected impact of EVs, including how to ensure they benefit the grid through programs like TOU and managed charging, will have the side effect of increasing the visibility of EVs as a transportation choice. This will also improve the economics to the EV owner and lead to an increase in sales.

D. *SB 1547*

In an attempt to support and accelerate transportation electrification, the Legislature included a section on EVs in SB 1547. That law requires the Public Utility Commission to:

> [D]irect each electric company to file applications, in a form and manner prescribed by the commission, for programs to accelerate transportation electrification. A program proposed by an electric company may include prudent investments in or customer rebates for electric vehicle charging and related infrastructure.[16]

The legislation also provided the Commission with some criteria to use in determining cost recovery for investments and other expenditures, stating that the Commission consider whether the costs:

> 1. Are within the service territory of the electric company;
>
> 2. Are prudent as determined by the commission;
>
> 3. Are reasonably expected to be used and useful as determined by the commission;
>
> 4. Are reasonably expected to enable the electric company to support the electric company's electrical system;
>
> 5. Are reasonably expected to improve the electric company's electrical system efficiency and operational flexibility, including the ability of the electric company to integrate variable generating resources;
>
> 6. Are reasonably expected to stimulate innovation, competition, and customer choice in electric vehicle charging and related infrastructure and services.[17]

The first three are traditional criteria that would be used to examine utility distribution system investments. The fourth and fifth reflect benefits that can be achieved if the utility manages this new load correctly (See RMI's benefits above). The final criterion reflects a desire to dissuade the utility from extending its traditional monopoly on electric sales to EV charging.

It is important to recognize that CUB is reviewing PGE's plans as a series of pilots. When judging the prudency of pilots, strict application of cost effectiveness is not always required, because some of what is being "bought" is what is learned from the pilot. But this standard requires pilots to be designed to produce results that answer questions and help develop future cost effective programs.

[16] Enrolled Senate Bill 1547 (SB 1547-B) Page 13.
[17] Enrolled Senate Bill 1547 (SB 1547-B) Page 13.

III. PGE's TRANSPORTATION ELECTRIFICATION PROGRAM APPLICATION

PGE states two key goals to the EV Program Application:[18]

1. Increase customer acquisition of electric vehicles and other electric transportation options in our service area; and
2. Begin efficiently integrating electric vehicles into our system.

To meet these two goals, PGE proposes a series of pilot programs focused primarily on the first goal whose:

> near-term focus is to encourage and facilitate more people choosing electricity as a transportation fuel.[19]

A. *Outreach and Technical Assistance*

PGE argues that the "largest barrier to EV adoption is the lack of consumer awareness . . . of the benefits of driving electric," so it proposes a 5-year pilot for strategic outreach, education and technical assistance, which would include 1 FTE to manage these efforts.[20]

> To increase awareness and adoption of electric vehicles and to encourage smart EV charging, PGE proposes a broad outreach and technical assistance campaign. The pilot will provide technical assistance for commercial and industrial customers, specialized trainings for key industry stakeholders (i.e. dealers and builders), partner rewards, ride and drive events, and education on time-of-use rates to residential customers that drive electric vehicles.

PGE proposes 6 elements to its Outreach and Technical Assistance Pilot[21] including providing technical assistance, training for key stakeholders, Time of Use outreach and Regional Market Transformation.

[18] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017 page 8.
[19] Portland General Electric • 2016 Transportation Electrification Plan, December, 2016, page 8; *see also* UM 1811/PGE/100/Spak – Goodspeed/1 ("PGE's application details the Company's near-term efforts to accelerate adoption of transportation electrification and efficiently integrate electric vehicles (EVs) into the grid . . . .")
[20] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017 page 9.
[21] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017 page 38.

1. This Includes an Ongoing Program that is Embedded in Rates

It should be noted that PGE has been assisting customers with EV matters for several years, as it should. Non-residential customers who are considering fleet conversion or workplace charging likely contact their local utility as part of their investigation. Some of this is clearly part of the basic role of a utility responding to its customers, and not specifically contemplated as part of a pilot program. PGE should separate out the traditional on-going utility function which is already in rates and should continue to be funded in base rates, and not through a separate surcharge. To the degree that increasing adoption of EVs is increasing the need (and cost) of this traditional utility role (i.e., responding to customers), it should be an issue in PGE's general rate case (UE 319).

2. *Time of Use Rate Outreach to EV Drivers*

CUB is supportive of the TOU outreach. There is clear evidence to support TOU rates to reduce the cost on the system for the new load additional EVs will bring. However, as EVs penetrate the automobile marketplace, TOU becomes more expensive due to the steep ramp rate at the beginning of the off-peak period. This, combined with the fact that the charging period for Level 1 (120 volt) charging is often greater than the off-peak period, lead CUB to the conclusion that more effort is needed to move customers to TOU and ultimately managed charging. CUB will discuss this more later in this testimony.

3. Regional Market Transformation

PGE is not alone in developing an EV program. Other utilities in the region are developing similar programs. However, the auto marketplace is much larger than PGE's service territory—a fact that PGE's program application fails to consider at times. For example, one aspect of PGE's training program is auto dealers, but if its program is limited to auto dealers in

PGE's territory, it is missing some of the local market. Car dealers in Vancouver, Washington sell to Portland customers. Car dealers in PacifiCorp territory in NE Portland sell to PGE customers. There are regional dealerships that will inherently influence the distribution of EVs in the Company's service territory.

Given that the marketplace is regional, it makes sense for market transformation efforts to also be regional. CUB has encouraged PGE to push (and consider funding) a regional market transformation program at the Northwest Energy Efficiency Alliance ("NEEA"). While Regional Market Transformation is included in the list of activities that will be conducted as part of the Outreach and Technical Assistance Pilot, PGE has little to say about this activity. CUB encourages PGE to make this a central part of this pilot.

4. *Timing and Results*

On page 43 of PGE's plan, the Company identifies its expected results—which are focused on increasing sales of EVs. PGE states that it expects that the "direct impact" of its outreach and education program "have the largest impact early in the forecast period." PGE then shows a forecast of more than 150 new EVs in 2017 attributed to this project.[22] However, on the next page, PGE shows that the project will not begin until the 4th quarter of 2017, when it begins hiring technical staff, contracting for partner rewards (which starts with an RFP process), and conducting baseline surveys.[23] PGE makes no attempt to explain how its 2017 actions relate to a 2017 goal of increasing EV sales, and timing of the commencement of its Outreach, Education, & Technical Assistance pilot casts doubt on the accuracy of the forecast on page 43, Table 8.

[22] UM 1811, PGE Application for Transporation Electrification Programs, page 43, Table 8.
[23] UM 1811, PGE Application for Transporation Electrification Programs, page 44.

B. *Electric Mass Transit*

PGE is proposing to finance, install, and manage six electric bus charging stations for Tri-Met.[24] Like automobiles, electric buses are more expensive to purchase than internal combustion, but the reduced cost of fuel and maintenance will offset the higher cost over the life of the bus. By purchasing the charging infrastructure, PGE enables Tri-Met to purchase five electric buses rather than four.

This program is not cost effective under the customer perspective test, the total resource cost test, or the societal cost test. CUB has two significant concerns with it:

1. *There is a Mismatch in Useful Lives*

PGE is ratebasing the chargers with a useful life of 10 years.[25] Tri-Met buses have expected useful lives of 16 years.[26] Who is taking on the responsibility to replace the chargers at the end of their useful life? Because PGE's pilots look out 10 years, it is not clear what the expectation is for replacing PGE's equipment.

2. *Will PGE Owning Chargers set a Precedent?*

By stepping in and financing the chargers, PGE has brought more money to the table and allowed this program to expand from 4 to 5 buses. Ultimately, Tri-Met wants to run a fleet of electric buses. And as a public transit agency, Tri-Met has lower financing costs that a private utility like PGE. CUB is concerned that this pilot could lead PGE and Tri-Met to believe that this is a good model for electrifying the fleet. Because it is not cost-effective, and because it increases the financing cost of electrifying the Tri-Met fleet, it should not be a model for future programs.

[24] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017 p. 16.
[25] CUB Exhibit 102.
[26] UM 1811 • PGE Application for Transportation Electrification Programs • March 15, 2017 p. 27.

3. *CUB Supports this Program as a Pilot*

As a pilot, however, CUB supports this program. Tri-Met has 659 buses.[27] As Tri-Met systematically goes electric over the next couple decades, PGE is going to have to manage the load. Earlier, CUB discussed the harms RMI identified could happen to the utility system if it did not prepare for the charging of EVs, and, conversely, the benefits it could gain if the Company did adequately prepare. With their large batteries, and need for fast charging, Tri-Met's fleet has potential to either benefit or harm the utility system. PGE has room to learn a great deal about managing Tri-Met's load, and using Tri-Met's charging to support the grid. This can improve PGE's ability to offer a cost-based line extension allowance for Tri-Met charging and identify demand response programs that would allow Tri-Met to support the grid and be compensated for that support. But the expectation for future programs should be less about PGE adding some of Tri-Met's equipment to its rate base, and instead about how electrifying Tri-Met's fleet can benefit PGE's system.

C. *Community Charging Infrastructure Pilot*

PGE is proposing to finance and add six additional Electric Avenue Charging Stations beyond the one it owns at its Headquarters.[28]

PGE offers three reasons for this, which CUB addresses below:

- Increased EV sales. Lack of public charging infrastructure is a barrier to sales;
- It is necessary to bring charging to customers who do not have off-street parking; and
- Lack of public charging for shared vehicles.

[27] https://en.wikipedia.org/wiki/TriMet
[28] UM 1811, PGE Application for Transporation Electrification Programs, page 47.

1. *Increased EV Sales*

PGE identifies this as the primary benefit of its investment in charging stations.[29] PGE is fond of two quotes relating to the need for home charging. Both appear multiple times in PGE's testimony and program application:

> Increased availability of public charging stations has a statistically and economically significant impact on EV adoption decisions.[30]

> Lack of robust DC Fast Charging infrastructure is seriously inhibiting the value, utility, and sales potential of medium-range battery electric vehicles.[31]

PGE also cites to Oregon having 915 gas stations and only 105 fast charging stations when concluding that:

> Most customers don't consider electric vehicles when shopping for a car and those who do can frequently be discouraged by the lack or confusing nature of charging infrastructure.[32]

This argument is not that people need public charging, since it is geared towards folks who have yet to purchase an EV, but that people need to see a visible public charging network before they purchase an EV.

As we discussed as part of the context for this filing (pages 3-4), Oregon leads the country in public charging. One source even needed capitalized emphasis to fully capture the depth of Oregon's public charging infrastructure: Oregon has a LOT of publicly available EV charging stations.[33]

[29] UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017 p. 68.
[30] UM 1811/PGE/100/Spak-Goodspeed/14-15.
UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017 p. 37.
UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017, p. 48.
[31] UM 1811/PGE/100/Spak-Goodspeed/15.
UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017 p. 37.
UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017, p. 48.
UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017, p. 49.
[32] UM 1811. PGE Application for Transportation Electrification Programs, March 15, 2017, p 96.
[33] EV Obsession, *supra* note 7.

Oregon is an "outlier." It is a leading state for EV sales, but has no state incentive on EV purchases. A likely reason for this is that Oregon has the country's best public charging network. If there is a threshold of community charging that is necessary to get folks comfortable, it is possible that Oregon has hit that threshold. If there is anywhere that might have sufficient charging infrastructure to support sales, it would be the State with the largest per capital network.

CUB asked PGE:

> PGE discusses the need to have public charging as an educational tool that motivates people to think about EVs, and as a way to reduce range anxiety for consumers who have not yet purchased an EV. How many charging stations are needed per capita to serve as an effective educational tool?

PGE answered:

> While PGE was developing the proposed transportation electrification pilots, we sought an answer to this question through literature review and consulting with Navigant's EV charger forecasting team. However, since the public charging industry is still in its relative infancy, there are currently no studies that we have identified that directly answer this question. This, in part, is why we proposed a quick charging network that is modest in size. We believe 6 new quick charging sites is the smallest viable network that will allow us to provide accessible, visible and reliable quick chargers for our customers and get meaningful feedback. [34]

There is some evidence nationally showing a positive correlation between a good public charging network and an increase in EV sales. Oregon is evidence of that connection. However, there is no evidence that continuing to build public chargers beyond the current public network is necessary to support EV sales. While there are less DC fast charging locations than gas stations, drivers cannot fill up their gas tanks at home while they sleep. The comparison is not without qualification.

This, of course, does not mean that public charging stations are a bad idea, or are not worthy of PGE's investment. Instead, it means that increasing sales of EVs has not been shown

[34] CUB Exhibit 103.

to be an adequate reason for adding more stations. EV drivers who need to extend their range will still need public charging. Residents without off-street parking will still need public charging. Electrified car share programs will still need public charging. But each need may require a different charging infrastructure.

2. *It Is Necessary to Bring Charging to Customers Who Do Not Have Off-Street Parking*

PGE's second purpose of public charging is that it is necessary for customers without off-street parking. Currently, most charging happens at home. This does limit EV ownership to families that have off-street parking. In Portland, two-thirds of new housing is expected to be multi-family housing. [35] While some multi-family housing will have parking, much of it will not. However, with one exception, PGE's proposed pricing structure does not support using PGE's public charging network as the primary source of electricity.

One of the benefits of owning an EV is reduced fueling and maintenance costs. Navigant's Total Resource Cost Test shows gasoline savings as the large benefit of an EV.[36] However, PGE projects an average charging rate of 60 cents/kwh for its new charging network.[37] This is more than 6 times the cost of their standard residential tariff. Someone relying on this price for charging would not find an EV to be a cost effective transportation choice.

PGE acknowledges this as a problem but believes that SB 1547 constrains them:

> We expect a lesser percentage of usage by multi-family dwellers or TNC drivers who do not otherwise have access to home charging. In such cases, public charging may be less cost effective than alternative fuels. Though we would like to offer all customers an opportunity for low cost charging, we have no plans to offer prices lower than current competitive market rates, given considerations in

[35] Portland Plan, Background Report Overview, Housing, 1/28/10. http://www.portlandonline.com/portlandplan/index.cfm?a=270959&c=51427
[36] Navigant Consulting, Cost-Effectiveness Results of Transportation Electrification Program Options, p. 17 (PGE Application, Appendix A, p. 19)
[37] CUB Exhibit 104.

SB 1547 related to competitive impacts of utility participation in the EV charging marketplace.[38]

CUB recognizes PGE's dilemma, but the competitive charging currently available does not provide economic charging for households without off-street parking. Public charging is priced at a level that supports extending the range for customers who primarily charge at home or work. Mimicking competitive pricing does not solve this problem.

There is one exception to PGE's uneconomic charging. PGE will allow its customers to purchase a monthly subscription for $25 per month and then charge for free off-peak. This does make daily charging economic for PGE customers who do not have off-street parking and can manage their charging during the off-peak period. CUB supports this element of PGE's pricing.

CUB will discuss multi-family housing later in this testimony.

3. *Shared Vehicles*

The final purpose stated in PGE's testimony was shared vehicle programs, referencing both the Car2Go, BMW Reach, and Flexcar models and the Uber/Lyft models. To the degree that these companies electrify, they will need places to charge. However, these are also built on profitable business models. The question will become whether the mix of uneconomic on-peak and economic off-peak charging will allow them to compete.

CUB does have once concern, though, that someone will develop a business model built around exploiting the free off-peak pricing. The monthly fee is per customer, not per EV. One could imagine a single customer sponsoring several Chevy Bolts that are used in a Uber/Lyft type service, with an average usage of 200 miles per vehicle/per year. People respond to economic incentives. PGE should consider designing a system that would allow it to require a

[38] CUB Exhibit 103.

monthly fee for each vehicle or limit the total volume of "free" electricity[39] that a customer can get from a month subscription. Even if PGE does not put such a limitation in place at the beginning, it may need to later.

4. *Business Case*

PGE's cost effectiveness is based on the number of new cars that will be purchased due to PGE's investment in charging infrastructure. But there is little evidence to support the claim that additional charging stations will cause more EVs.

But that is acceptable, because the real issue with charging infrastructure should be how it will be used, and how it integrates EVs into the Grid. Because this is a pilot, the lessons PGE learns are an important part of the cost effective equation.

PGE estimates that the total cost of the Community Charging Pilot will be $4.1 million, which will be offset by $3.5 million in revenue (10 year NPV). Considering that this is a pilot, and it provides a service to PGE customers who have electric vehicles, $600,000 as the net 10-year cost is not something with which CUB takes issue.

Unfortunately, CUB does not believe there is a great deal of basis for PGE's projections of revenue. The current Electric Avenue is free. As Tom Peterson, the famous Portland pitchman, used to say in late night television ads, "Free is a very good price."[40] This author has personally used Electric Avenue but would not have done so if the cost were more than home charging.

CUB asked PGE about how much usage at Electric Avenue was based on free electricity and PGE responded:

> From PGE's past experience with the EV project, the charging activity reduced by approximately 50% when a fee was first introduced (like Electric Avenue, there

[39] UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017.
[40] https://www.youtube.com/watch?v=go2ZcEsixD0

> was no payment required when the sites launched) and then rebounded to its earlier utilization. We expect a similar response at Electric Avenue when the fee in implemented. [41]

CUB does not believe that the EV Project is a good basis to project what will happen with Electric Avenue. The EV Project refers to the Ecotality charging stations[42], not to Electric Avenue and the design, location, and usage of those charging stations is very different than Electric Avenue.

PGE expects that the charging at the current Electric Avenue will decrease when it starts charging for service but will rebound to current usage. CUB Confidential Exhibit 106 contains PGE's Electric Avenue current usage and charging forecasts. The fact that these are confidential numbers suggests that the Company sees this as a competitive business. PGE's projections assume that customers will pay an average price of [redacted] cents/kwh and that usage during the first year will be [redacted] kwh/month. Usage during the most recent month, March 2017, was [redacted] kwh. The largest volume, and most expensive, is the charging associated with subscribers--PGE customers who pay a monthly subscription. However, these customers can take advantage of "free" off-peak charging. But if they do, PGE will receive less revenue from its charging station. PGE's current pricing (free for all, all the time) means that EV drivers who can charge at home can save money by utilizing PGE's free alternative. Once the cost is greater than home charging, customers will be less likely to use it as an alternative to home charging. Customers who use it to extend their range will still use it. But ultimately, these are drastic changes in price signals, and projections of how customers will respond should be taken with several grains of salt.

[41] CUB Exhibit 105.
[42] UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017, Appendix B, p. 2.

5. *Future Plans*

PGE would like to build up to thirteen more Electric Avenues.[43] At this point, it is not clear that this is a good model and will be successful. It is not clear why PGE has determined that six is the right number of Electric Avenues today, and maybe thirteen more will be helpful later. Will the primary goal of the additional stations also be to incentivize new car sales?

CUB believes that it makes more sense to consider what is needed to support EVs as they grow in PGE's service territory. For example, there will be a real need to identify how to bring affordable charging to multi-family housing. Electric Avenue may or may not be the best design for multi-family housing.

6. *Pacing*

Rather than looking to build six Electric Avenues at one time, CUB recommends PGE to identify one or two additional sites, while simultaneously adding a price to its existing Electric Avenue. After that, parties should examine the usage at the new site and the existing Electric Avenue after a year. This will allow us to examine the uses. For example, we may see a great deal of off-peak charging and find that this is a good model for daily usage for residents of multi-family housing, which could affect future decisions regarding location.

CUB believes that as more EVs are on our roads, there will be an increased need for additional community charging infrastructure to extend ranges, to support multi-family dwellers, and to support car sharing programs. The most advantageous infrastructure for these different business cases may be different. A thoughtful approach is necessary to make sure we are putting the right infrastructure in the right location and charging the right prices. CUB remembers well the Ecotality experience, in which Ecotality received stimulus monies to add charging infrastructure throughout the area, but much of this was rarely used. EV drivers were not

[43] UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017.

interested in "topping off their tanks," while they shopped at Fred Meyer for prices that were 3 or more times their residential rates. We need infrastructure, but we need to do it right.

D. *Residential Smart Charging Pilot*

In its December filing, PGE's fourth element was called Research, Development and Small Pilot Projects. This included PGE's employee pilot, PGE's workplace pilot, its Vehicle-to-Grid pilot, and its Bring Your Own Home Charger Pilot.[44] In its March 2017 revised filing, the Company redesigned this element, and it is now called the Residential Smart Charging Pilot. CUB hopes this is a sign that PGE sees integrating EVs and using them to support the grid is important to avoid negative consequences.

III. TOU, MANAGED CHARGING, & LEVEL 2 INCENTIVE

PGE's EV plan is primarily focused on increasing EV sales. That is the "primary benefit" of the Outreach and Technical Assistance Program and the Electric Avenue Program.[45] These two programs represent three-fourths of the revenue requirement increase PGE is seeking.

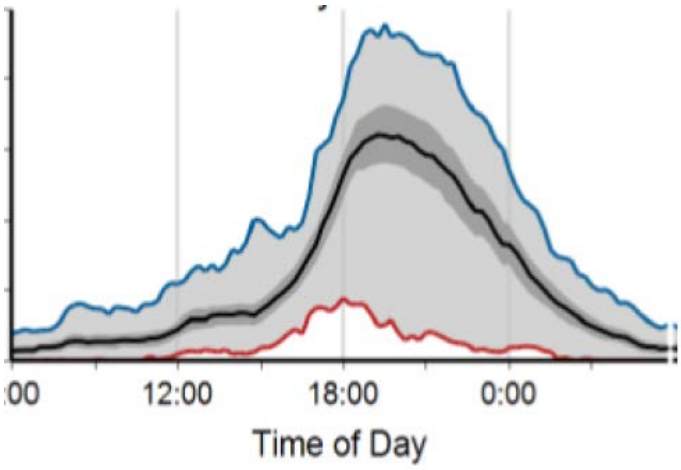
PGE is forecasting there will be 113,265 EVs in its service territory by 2025, without PGE's programs. As stated, CUB is concerned that there is not enough focus on those additional vehicles and how to turn them from system costs to system benefits. Most vehicles are charged at home and there is potential for adding costs to PGE's system:

> A study by Xcel Energy concluded that if EVs charge during peak periods, as many as 4% of the distribution transformers on its system could be overloaded at local EV penetration rates of just 5%, even if EV adoption is geographically dispersed.[46]

[44] PGE, 2016 Transportation Plan, December 2016, p 63-67.
[45] UM 1811, PGE Application for Transportation Electrification Programs, March 15, 2017, p. 68.
[46] Garrett Fitzgerald, Chris Nelder and James Newcomb. Electric Vehicles as Distributed Energy Resources, Rocky Mountain Institute, 2016, p. 26.

A. *TOU and Managed Charging*

First, it is important to recognize that many people have flexibility regarding when they can charge a car, and TOU rates do influence that. Consider the following EV charging patterns:[47]

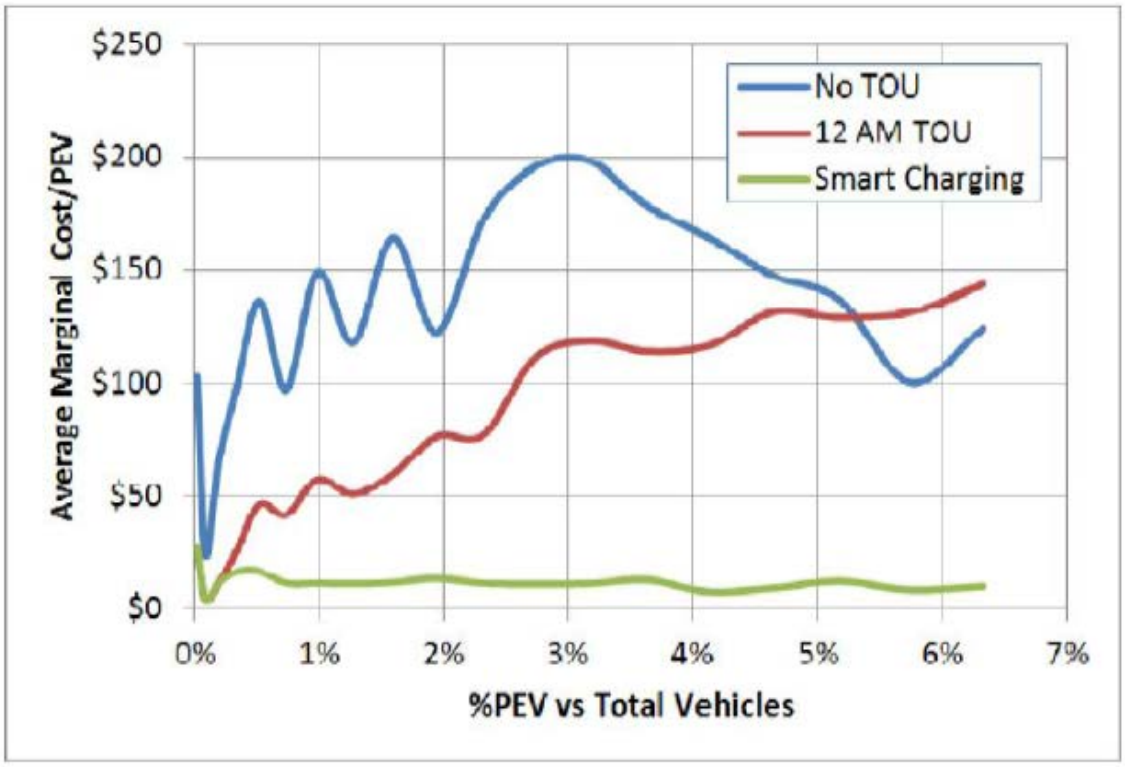


Dallas/Ft Worth
(standard rates)

TOU rates clearly influence drivers to wait until the off-peak period to charge. However, it is important to recognize that there is a steep ramp to the load at the beginning of the off-peak period. This makes little difference when there are few EV drivers, but once EV drivers reach

[47] Jim Lazar, presentation to NESCAUM Transportation Electrification workshop. Source: M.J. Bradley, 2017.

about 5% of the automobiles, this adds costs to the system, as shown here:[48]



SOURCE: Berkheimer et al SAE Paper, 2014

This shows that the added cost of new EV load is less under TOU charging than standard rates, but only until a little more than 5% of vehicles are electric. After this, TOU is more expensive. This makes sense because of the steep ramping curve right at the off-peak period. But the bottom line on the graph reflects smart charging, sometimes called managed charging or dispatchable charging, which starts at a lower cost and remains there.

The Pacific NW National Energy Labs did a study a few years ago that found that, if 13% of the vehicles on the road were electric, we could integrate 3.7 GW of wind with managed charging.[49]

[48] Jim Lazar, presentation to NESCAUM Transportation Electrification workshop. Source: Berkheimer *et al* SAE Paper, 2014.

> With better coordination or control, however, most EV charging can be spread out across off-peak periods to minimize these impacts, even as penetration reaches much higher levels, and avoid the need for investments in system reinforcements.
>
> A recent 18-month pilot project in the UK called My Electric Avenue demonstrated the use of just such a control system to manage ten clusters of seven to twelve Nissan Leaf EVs, with 5% to 32% of properties in each cluster having EVs, and comprising more than 200 vehicles in total, on real distribution feeders using power line carrier signals.
>
> The project focused on demonstration of a management system that could be used to mitigate the potential impact of EV clusters in high-penetration neighborhoods. Up to three EVs were allowed to charge simultaneously within a residential cluster. The project showed that if 40% to 70% of customers owned EVs, 32% of low-voltage feeders would require upgrading, assuming 3.5 kW charging. Newer EVs, which can charge at up to 20 kW rates, would require more upgrading and/or charging cotrol. The study estimated that the use of its "Esprit" control technology could avoid more than $3 billion in distribution system costs between now and 2050.69
>
> While the My Electric Avenue pilot suggests a solution based on control systems managed by the utility, this is only one of several options. Control systems could also be managed by an aggregator, or coordinated through autonomous peer-to-peer systems. To be most effective at the local level, however, EV charging control points may need to be able to either "see one another" or be seen by an aggregator or controller in order to prevent coincident start times and distribute load as widely and flexibly as possible. This could be an important consideration for regulators and utilities as they consider alternative pathways for EV charging control.[50]

It may take some time before 5% of all vehicles on the road are electric and need to move to managed charging. With our climate goals saying that we eventually need 50% of vehicles to be electric, it is worth considering today the impact of one-tenth of that amount.

> There are even programs that allow grid support without fully managing the charging:
>
> These system benefits do not require a smart grid. For example, RMI's chief scientist, Amory Lovins, uses a Level 2 charger at his home, the experimental circuit of which measures grid frequency every second (within a ±0.040-Hz band) and instantaneously adjusts the charge rate between zero and seven kW according

[49] F. Tuffner, M Kintner-Meyer, Using Electric Vehicles to Meet Balancing Requirements Associated with Wind Power, Pacific Northwest National Laboratory, Executive Summary, p. iv.

[50] Garrett Fitzgerald, Chris Nelder and James Newcomb. Electric Vehicles as Distributed Energy Resources, Rocky Mountain Institute, 2016, p. 27.

> to whether the grid is short or long electricity—thus dispatching to the Western Interconnect seven kW of a valuable ancillary service called "fast grid regulation." If he were paid what FERC says this is worth, he'd earn a few dollars every night just by charging his EV.[51]

B. *TOU and Level 2 Charging*

Today many EV customers are satisfied with Level 1 charging (120 volt).[52] According to several online electric vehicle resources, EVs on Level 1 charging will gain between 2 and 5 miles per hour of charging.[53] This means that in PGE's 8-hour off-peak window, Level 1 charging will provide a driver with between 16 and 40 miles. The average American driver drives 13,474 miles per year[54] or 36 miles per day – near the upper end of what is possible with Level 1 at off-peak times. Many EV drivers will find that off-peak Level 1 charging does not provide enough power to get them through their daily needs.

As discussed above, TOU charging will reduce the incremental cost to the electric system from this new, growing load, until EVs are more than 5% of vehicles, at which point managed charging is the key to keeping costs down. Just as long charging times are a barrier to TOU charging, they will also be a barrier to managed charging. If an EV is hooked up to a charger for 10 hours, but needs all 10 hours to charge, there is little room to manage that charge. But if the EV only needs 3 hours of a 10-hour window, then there is significant room to manage the charging time and minimize cost. In either case, TOU or managed charging, Level 2 charging is necessary.

[51] Garrett Fitzgerald, Chris Nelder and James Newcomb. Electric Vehicles as Distributed Energy Resources, Rocky Mountain Institute, 2016, p. 25.
[52] CUB was unable to find good data on the percent of home charging that is level 2. There are several sources that state that "most" home charging is Level 1, but offer nothing more specific.
[53] http://www.fleetcarma.com/electric-vehicle-charging-guide/
http://evobsession.com/electric-car-charging-101-types-of-charging-apps-more/
https://chargedevs.com/features/the-realities-of-ev-charging/
[54] https://www.fool.com/investing/general/2015/01/25/the-average-american-drives-this-much-each-year-ho.aspx

C. *Incentives for Level 2*[55]

Since most charging happens at home and in an effort to minimize costs, TOU is ideal for the short term and managed charging is best for the long term. This suggests that an effort should be made to convert Level 1 home charging to Level 2. CUB believes that PGE should consider an incentive for Level 2 charging. Such an incentive can be tied to the customer signing up for TOU. Such an incentive should be designed to be cost effective, based on costs associated with PGE's system. CUB believes there are a couple possible ways to determine such a cost-based incentive, but CUB recognizes that a cost-based incentive requires PGE's to make some determinations of the attendant costs and benefits on its system. The following are examples of how CUB thinks such a cost-based incentive could be developed:

1. *Line Extension Policy*

PGE has a line extension policy that allows some funds to be made available for extending service drops to new customers. For residential customers, it is $1,623 per dwelling unit.[56] For other classes it is a credit based on annual expected kwh.[57] EVs are new load, which will contribute to joint and common costs, thereby putting downward pressure on rates. Applying the Schedule 32 line extension rate to an EV would justify a $530 utility payment towards a Level 2 charger.[58] The concept of a line extension allowance is straightforward. While there may be costs associated with hooking up new load, that new load will contribute revenues, including revenues which support joint and common costs. By identifying the projected load and its contribution toward shared fixed costs, a utility can justify spending some money extending

[55]CUB's witness (and Executive Director) owns a PHEV and would be eligible for any incentive for home based Level 2 charging. While CUB believes that any incentive should be cost-based and only reflect system benefits from the EV, CUB recognizes that proposing an incentive that a witness is eligible for presents a conflict. Therefore, to remove any conflict of interest, the witness pledges not to accept any Level 2 charging incentive developed by PGE based on CUB's recommendations.
[56] PGE Schedule 300, Rule I.
[57] PGE Schedule 300, Rule I.
[58] See PGE schedule 300, line extension credit 14.73 cents/kWh – assuming 10 kwh per day.

service to that load. For NW Natural, for example, the line extension is based on 5 years of contribution to fixed costs. In essence, this means that customers help pay to extend service to a new customer, that new customer "pays" the system back over five years, after which the system benefits from the new load. PGE can calculate a similar "line extension allowance" based on the contribution to fixed costs associated with EVs and offer this as an incentive for Level 2 and TOU.

2. *TOU Benefit*

As we have shown above, there is a benefit from TOU charging based on a reduction in utility costs as compared to standard rates. The study CUB cited above was not from PGE's service territory.[59] PGE, however, could use a similar methodology to determine the difference in cost to its system from TOU versus standard rates and use that difference to offer an incentive for Level 2 charging with TOU.

3. *Types of Incentives*

Once PGE has determined the value of charging and the level of utility payment that would be cost justified, it needs to consider the best way to deliver that incentive.

Rebates. PGE could simply offer EV customers a rebate on a home Level 2 charger that met the standards PGE identifies as necessary. Again, this could include a requirement for TOU.

Wholesale procurement. PGE could also use competitive bidding to source Level 2 chargers and offer these to customers at cost (minus incentive). Metro, the regional government in the Portland area, formerly used wholesale procurement to acquire backyard composters that were then resold at cost to garbage customers in a successful program to reduce solid waste. A

[59] Jim Lazar, presentation to NESCAUM Transportation Electrification workshop. Source: Berkheimer et al SAE Paper, 2014.

similar program would also allow PGE to ensure the chargers had attributes that allow car only TOU or will later enable managed charging.

PGE has some discussion of this and identifies TOU charging at home as the way to benefit the system, and some of PGE's education efforts will go towards promoting TOU charging. While CUB agrees that at this point it makes sense to pursue TOU charging, CUB thinks PGE should look beyond TOU and consider the benefits of managed charging. For either TOU or managed charging, CUB believes that Level 2 charging is necessary.

IV. OREGON CLEAN FUELS PROGRAM (LOW CARBON FUEL STANDARD)

CUB was disappointed that PGE did not sign up to aggregate residential home charging as part of the Oregon Clean Fuels Program (CFP). Under Oregon Department of Environmental Quality ("DEQ") rules, the electric utility has first choice on being the credit aggregator. By not doing so, PGE has left money on the table that could be used to benefit EV drivers within its system.

CUB is not persuaded by PGE's explanation of why it chose not to sign up as a credit aggregator last October. For example, PGE's first reason is that the benefits of the program for PGE customers at this point in time are speculative and temporal at best.[60] This is particularly unavailing, as the benefits of nearly every activity in PGE's Transportation Electrification Program Application are speculative. While there might be some administrative costs, DEQ is committed to minimizing them, and the costs are likely to be much less than most other programs in PGE's plan.

[60] Portland General Electric • 2016 Transportation Electrification Plan, page 77.

The reality is that, the CFP is politically controversial and some in the larger business community would like to eliminate the program. CUB is concerned that this has influenced PGE to keep its distance from the CFP.

PGE will have another chance to register this October. If PGE fails to register, the Commission should consider: (1) imputing the revenue associated with PGE's residential credits; and (2) requiring PGE use those credits to benefit the EV customers who purchased the vehicles that generated the credits.

Staff estimates that the average residential customer will "generate approximately 2.5 credits annually, worth an estimated $150.[61] These funds could be used to advance transportation electrification. For example, PGE could offer this as an annual or monthly credit to customers who charge EVs at home. Just as free parking in Hawaii and use of High Occupancy Lanes in Southern California are believed to help support EV sales,[62] a Clean Fuel discount on electric bills encourages customers to purchase EVs. Just as importantly, offering a credit to customers who register their EVs with PGE would identify the charging load, and this would have immense value to PGE. Currently, little is known about the real impact of charging on PGE's system. It is unknown how many customers charge at Level 1 versus Level 2. It is unknown how many customers begin charging when they get home after work, which often coincides with PGE's peak usage. Understanding the real impact of charging, would allow PGE to design cost-based programs designed to minimize the cost to its customers and maximize the benefits.

[61] Nolan Moser and Jason Salmi Klotz, Staff Report, Item 2, Oregon PUC Public Meeting, April 18th, 2017.
[62] http://www.theicct.org/blogs/staff/oregon-success-story-electric -vehicles

V. EXPANDING HOME CHARGING OPPORTUNITIES

Currently most EVs are charged at home. PGE's survey of potential EV purchases found that 74% of them expected to do most charging at home.[63] With many more EVs coming, PGE should consider additional programs that focus on home charging. CUB urges PGE to develop plans for the following areas:

A. *New Construction*

We, in the Pacific Northwest, know from our history with energy efficiency that new construction is an opportunity for efficient use of energy. While many existing homes would require retrofits to support Level 2 home charging, new construction can provide wiring at a significantly lower cost. Since most housing will last for decades, and Oregon's climate change goals will require half of automobiles to be electric, ensuring that new home construction include wiring to allow easy installation of Level 2 charging will lower the cost of infrastructure. This can be accomplished through codes or incentives. The City of Portland is working on this, but PGE's service territory extends beyond the city, and PGE should consider either an effort to include this in codes or should consider a small rebate or other incentive to home builders.

B. *Multi-Family with Parking*

Multi-family housing is problematic for home charging. For multi-family housing that includes parking, having charging installed in the parking lot makes a great deal of sense. With multi-family charging, the first question is who is paying for the bill. Is it billed at a commercial rate to the complex (like the laundry room, the pool or other common spaces), which in turn recovers the cost by spreading it across all tenants' rents? Or is it billed to the EV driver at the retail residential electric rate or the public charging rate? At a minimum, PGE should design some generic products for landlords who want EV charging. For example, a product that allows

[63] Portland General Electric • 2016 Transportation Electrification Plan, page 26.

tenants to type in a code and add the cost to their electric bills would allow multi-family residents to charge at a similar cost as single family residents. The idea is that if a renter wants to purchase an EV, his or her landlord can provide a quick answer on how to supply charging services. PGE should actively work on this problem.

C. *Multi-Family without Parking*

This is one of the more difficult challenges for home charging. PGE's proposed pricing for Electric Avenue has one nighttime option that would work well for these customers, but it would require a nearby electric avenue. PGE should work with the City of Portland to develop an approach that would allow dedicated on-street Level 2 parking/charging in neighborhoods where EV drivers request it.

VI. CONCLUSION

CUB applauds PGE for working with stakeholders to develop a plan to achieve the goals of SB 1547. CUB is concerned that PGE's plan is too heavily focused on increasing the sales of EVs, rather than managing the EV growth on its system. CUB believes a solid plan to manage EVs on the system will inherently increase the sale of EVs.

With respect to specific Programs:

Outreach, Education and Technical Assistance. CUB recognizes that this is an important and necessary role for an electric utility. However, outreach and education is part of the basic role of an electric utility in response to the needs of its customers. PGE has been offering outreach, education, and technical assistance related to EVs for the last several years and will continue to do so, regardless of SB 1547. CUB recommends that PGE identify which parts of this program are part of on-going utility programs and encourage those parts to continue to be supported through basic rates, rather than through transportation electrification pilots.

Electric Mass Transit. PGE proposes financing Tri-Met's charging equipment to allow Tri-Met to purchase one additional electric bus. CUB is supportive of this program, because PGE can use it to learn about managing significant charging load. However, CUB is concerned about this as a model for electrifying Tri-Met's fleet. PGE has a higher cost of capital than Tri-Met, so it makes little sense in the long run for it to finance parts of Tri-Met's conversion to electric buses. In addition, there is a different useful life between the charging equipment and the buses. CUB urges PGE to clarify what its role will be in the long run with regards to Tri-Met's conversion.

Electric Avenue Expansion. PGE wishes to build six new Electric Avenue charging stations now, with the primary benefit of expanding EV sales, and then build thirteen more later. Oregon already has the best charging network in the country. Because the current Electric Avenue is free, CUB is concerned that PGE's projections are speculative, at best. CUB believes that the subscription with free off-peak charging may be a good system for households without off-street parking. CUB suggests that PGE slow down this expansion, so it can learn how pricing affects charging, identify the primary users of public charging, and ensure that future investments are well placed. While increased EVs will require additional public charging, CUB believes the charging network might have different locations, designs and prices, depending on the EV segment using that charging equipment.

Residential Smart Charging Pilot. CUB supports PGE's Residential Smart Charging Pilot.

TOU, Managed Charging, and Level 2 Incentive. CUB urges PGE to focus more effort on incentivizing customers to move towards TOU and, ultimately, managed charging. To do so, CUB believes that customers need Level 2 charging at home. PGE should offer an incentive for

Level 2 TOU charging, based on traditional line extension principles and the reduction of costs associated with TOU.

Clean Fuel Program. PGE should have elected to become the aggregator for residential EV charging credits under the State's CFP. PGE should elect to become the aggregator in the fall of 2017. If it fails to do so, the PUC should impute the revenue that would have been generated, if the Company had participated in the CFP.

Expanding Home Charging Opportunities. Most EV charging happens at home. PGE should identify programs that target: (1) new Home Construction; (2) multi-family housing with parking; and (3) multi-family housing without parking to economically expand EVs charging to more customers.

WITNESS QUALIFICATION STATEMENT

NAME: Bob Jenks

EMPLOYER: Citizens' Utility Board of Oregon

TITLE: Executive Director

ADDRESS: 610 SW Broadway, Suite 400
Portland, OR 97205

EDUCATION: Bachelor of Science, Economics
Willamette University, Salem, OR

EXPERIENCE: Provided testimony or comments in a variety of OPUC dockets, including UE 88, UE 92, UM 903, UM 918, UE 102, UP 168, UT 125, UT 141, UE 115, UE 116, UE 137, UE 139, UE 161, UE 165, UE 167, UE 170, UE 172, UE 173, UE 207, UE 208, UE 210, UE 233, UE 246, UE 283, UG 152, UM 995, UM 1050, UM 1071, UM 1147, UM 1121, UM 1206, UM 1209, UM 1355, UM 1635, UM 1633, and UM 1654. Participated in the development of a variety of Least Cost Plans and PUC Settlement Conferences. Provided testimony to Oregon Legislative Committees on consumer issues relating to energy and telecommunications. Lobbied the Oregon Congressional delegation on behalf of CUB and the National Association of State Utility Consumer Advocates.

Between 1982 and 1991, worked for the Oregon State Public Interest Research Group, the Massachusetts Public Interest Research Group, and the Fund for Public Interest Research on a variety of public policy issues.

MEMBERSHIP: National Association of State Utility Consumer Advocates
Board of Directors, OSPIRG Citizen Lobby
Telecommunications Policy Committee, Consumer Federation of America
Electricity Policy Committee, Consumer Federation of America
Board of Directors (Public Interest Representative), NEEA

April 4, 2017

TO: Sarah Ryan-Knox
Oregon Public Utility Commission

FROM: Karla Wenzel
Manager, Pricing

PORTLAND GENERAL ELECTRIC
UM 1811
PGE Response to CUB Data Request No. 003
Dated March 21, 2017

Request:

Will Tri-met chargers be rate based? What is the useful life?

Response:

Yes, PGE anticipates that the distribution system upgrades and the chargers will be rate based, minus the line extension costs that will be borne by TriMet directly. The useful life of the chargers is 10 years.

April 4, 2017

TO: Sarah Ryan-Knox
Oregon Public Utility Commission

FROM: Karla Wenzel
Manager, Pricing

PORTLAND GENERAL ELECTRIC
UM 1811
PGE Response to CUB Data Request No. 009
Dated March 21, 2017

Request:

In several place PGE discusses the need to have pubic charging as an educational tool that motivates people to think about EVs, and as a way to reduce range anxiety for consumers who have not yet purchased an EV.

- **a) Does PGE have any evidence that DC Quick chargers are more effective than Level 2 chargers as a motivational factor?**
- **b) How many charging stations are needed per capita to serve as an effective educational tool?**
- **c) PGE cites Amory Lovins (page 31), suggesting that personal cars will be replaced by shared electric autos. PGE makes the claim that transportation services within the urban environment will turn to electricity because it is the "most cost-effective fuel." PGE's cost effectiveness tests were the Rate Impact Test, the Total Resource Cost Test and the Societal Cost Test. PGE did not conduct a Participant (EV driver) Cost Test. What analysis does PGE have which shows charging at public stations is the "most cost-effective fuel" at the rates that PGE will charge for public charging?**

Response:

a) PGE's plan highlights a number of sources that speak to the need for public chargers to be quick, accessible, and reliable to make drivers comfortable with considering an electric vehicle. We include sources from Business Oregon, Plug Insights, NRDC, Customer Interviews, EPA, and Cornell University.

Energize Oregon. http://www.oregon4biz.com/assets/docs/EVrpt2013.pdf:

- "Beyond simply installing chargers, the build-out of a robust, connected PEV charging infrastructure in Oregon is important to help bridge the gap between Innovators and Early Adopters. With the deployment of a robust **fast-charging** network, the Northwest PEV driver will no longer be limited to the 100-mile

range of the typical PEV, but will be able to traverse the state to destinations that were previously unattainable."

Hajjar, Norman, New Survey Data: BEV Drivers and the Desire for DC Fast Charging, Plug Insights, March 11, 2014:

- "Lack of robust DC Fast Charging infrastructure is seriously inhibiting the value, utility and sales potential of medium range BEVs"

Baumhefner, Hwang, Bull. NRDC. Driving Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles (2016).

- "Drivers' purchase decisions are often disproportionately influenced by rare use cases; for example, the off-road capability of SUVs remains a driving force behind their market dominance, even though that capability is almost never used. Consumer research shows the lack of "robust DC fast charging infrastructure is seriously inhibiting the value, utility, and sales potential" of typical pure-battery electric vehicles."

Customer interviews/focus groups:

- "If it only lasted a few hours but recharged very quickly, that wouldn't be a big deal. If it only lasted a few hours and then you had to sit and wait while you charged for a few more, then that would be more of a barrier"
- One customer emphasized that it must not just be accessible but also fast: "As a single mom the logistics of it (public charging) do not work. It needs to take 15 minutes."
- "Charging availability, including the availability of quick charging, impacts EV use for Uber."

Consumer Acceptance of Electric Vehicles in the US. 2012. https://www.epa.gov/sites/production/files/2014-09/documents/kodjak121312.pdf:

- "If electric vehicles are to reach a broad market, rather than just serving as second cars for city dwellers with large garages, it will be essential to create a public electric charging infrastructure."
- "One survey found that 70% of drivers surveyed would expect an EV to travel 300 miles before they would consider purchasing one (Deloitte, Gaining Traction)." Though not a direct indicator that quick chargers are more of a motivation than level 2 chargers, indirectly quick chargers increase the range of EVs by allowing drivers to "extend their range" in minutes not hours.

- So-called "fast" chargers are not fast enough | 30 minute recharge unacceptable to mainstream customers | In one survey, auto executive explained: "You need an electric car that can recharge in five minutes – that's how a gas station works."

Li, S. et al., "The Market for Electric Vehicles: Indirect Network Effects and Policy Impacts," Cornell University, June 2015:

- The study found that "the increased availability of public charging stations has a statistically and economically significant impact on EV adoption decisions."

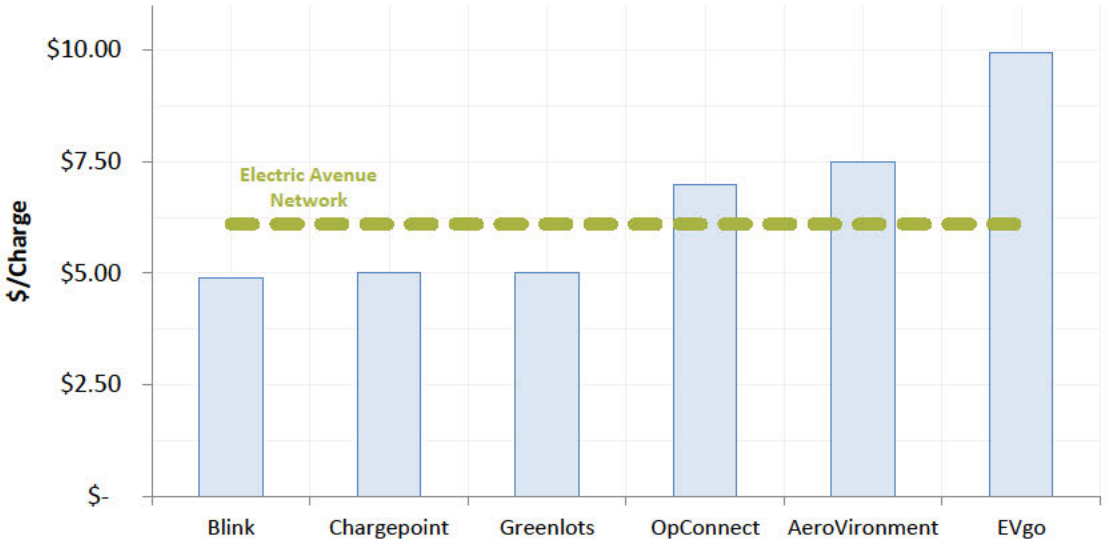
Public level 2 chargers do not adequately address customers' needs and expectations that they should be able quickly "fuel up" and get back on with their life (be it getting to school, continuing their road trip, picking up TNC passengers, etc.). Though most EV charging takes place at home, an accessible and reliable network of DC Quick Chargers can help educate and motivate customer to consider electric vehicles. On the contrary, we believe that investing in a large network of highly visible level 2 charging infrastructure would be imprudent. Highly visible public level 2 chargers and slow charge times could perpetuate a perception of slow charge time and might not effectively meet customer needs. s.

b) While PGE was developing the proposed transportation electrification pilots, we sought an answer to this question through literature review and consulting with Navigant's EV charger forecasting team. However, since the public charging industry is still in its relative infancy, there are currently no studies that we have identified that directly answer this question. This, in part, is why we proposed a quick charging network that is modest in size. We believe 6 new quick charging sites is the smallest viable network that will allow us to provide accessible, visible, and reliable quick chargers for our customers and get meaningful feedback.

c) As indicated in our filed application for programs, the majority of electric vehicle charging happens at home (on Schedule 7) and public charging is only needed in limited instances during the year. For most drivers, the cost per kWh of "EV fuel" should be weighted heavily to the standard home rate using Schedule 7.

We expect a lesser percentage of usage by multi-family dwellers or TNC drivers who do not otherwise have access to home charging. In such cases, public charging may be less cost effective than alternative fuels. Though we would like to offer all customers an opportunity for low cost charging , we have no plans to offer prices lower than current competitive market rates, given considerations in SB1547 related to competitive impacts of utility participation in the EV charging marketplace. As illustrated in Figure 10 of the plan, the proposed rates for Electric Avenue Network are designed to be comparable with existing market rates:

Figure 1: Comparison of Market Rates for Public Quick Charging[1]



[1] http://www.plugshare.com/

April 4, 2017

TO: Sarah Ryan-Knox
Oregon Public Utility Commission

FROM: Karla Wenzel
Manager, Pricing

PORTLAND GENERAL ELECTRIC
UM 1811
PGE Response to CUB Data Request No. 004
Dated March 21, 2017

Request:

PGE forecasts $3.5 million in income from Electric Avenue.

a. Based on PGE's modeling of usage, including fixed charges and variable charges, what is the average price per kilowatt hour that EV charging customers will pay for the expanded electric avenue electricity?

b. Please provide work papers for the 3.5 million estimate.

Response:

a. PGE's projection of the average price per kilowatt hour that the EV customers will pay for the use of the public charging network is as follows:

Electric Avenue Network - Average Price ($/kwh)	
Pilot Program (6 New Stations)	0.65
Electric Avenue 2.0 (Built in 2015)	0.55
Existing Satellite Sites (Built 2010-2013)	0.47
Composite	0.60

b. $3.5m is the net present value (NPV) of 10 years of revenue from customers that use PGE's proposed network of charging stations. Please see Attachment A, which calculates the forecasted revenue of the Electric Avenue network. Attachment 004-A is protected information subject to Protective Order No. 17-132.

UM 1811

Attachment 004-A

Provided in Electronic Format only

Protected Information Subject to Protective Order No. 17-132

April 4, 2017

TO: Sarah Ryan-Knox
Oregon Public Utility Commission

FROM: Karla Wenzel
Manager, Pricing

PORTLAND GENERAL ELECTRIC
UM 1811
PGE Response to CUB Data Request No. 007
Dated March 21, 2017

Request:

With regards to the current Electric Avenue:

a) **What was the cost of Electric Avenue?**
b) **What does PGE charge customers for electricity?**
c) **What does the city charge customers for parking?**
d) **Does PGE have any analysis that identifies how much of the charging activity is motivated by discounted parking and electricity versus need to charge vehicle?**
e) **Will PGE charge the same rates at the current Electric Avenue as it does at its new Electric Avenues?**

Response:

a) The cost of Electric Avenue was $319,504.

b) Currently, PGE (doing business as World Trade Center Properties) is sponsoring the cost of electricity for charging at Electric Avenue.

c) PGE interprets this question to ask about the City of Portland. The city charges $2.00 per hour for parking during the times that parking fees apply. For all other times, parking is free.

d) From PGE's past experience with the EV project, the charging activity reduced by approximately 50% when a fee was first introduced (like Electric Avenue, there was no payment required when the sites launched) and then rebounded to its earlier utilization. We expect a similar response at Electric Avenue when the fee is implemented.

e) PGE anticipates that Electric Avenue will be in the same network and therefore have the same fee structure, although total cost may vary between sites depending on the need to collect parking fees.

CUB Exhibit 106 is both confidential and voluminous and was submitted on CD to each party designated to receive confidential information pursuant to Order 17-132.